

What Is The Height Of A Right Circular Cylinder That Has A Volume Of 48 Cubic Centimeters And A Radius

What Is The Height Of A Right Circular Cylinder That Has A Volume Of 48 Cubic Centimeters And A Radius

Understanding the dimensions of geometric shapes is fundamental in mathematics, engineering, architecture, and various sciences. Among these shapes, the right circular cylinder is a common figure with practical applications ranging from storage tanks to mechanical components. A typical problem encountered involves determining the height of a right circular cylinder when its volume and radius are known. Specifically, in this article, we explore the question: What is the height of a right circular cylinder that has a volume of 48 cubic centimeters and a given radius? We will delve into the geometric principles involved, derive the necessary formulas, consider different scenarios, and provide detailed examples to clarify the process.

Understanding the Right Circular Cylinder

A right circular cylinder is a three-dimensional geometric figure with two parallel circular bases of equal size and a curved surface connecting these bases. Its defining characteristics are:

- Two congruent circular bases
- A height (the perpendicular distance between the bases)
- A radius (the distance from the center of a base to its edge)

Visualizing the shape helps: imagine a can of soup or a drum—these are typical examples of right circular cylinders.

Key Components and Notation

Before diving into calculations, let's define the critical variables

involved:

- r : radius of the circular base (measured in centimeters)
- h : height of the cylinder (measured in centimeters)
- V : volume of the cylinder (measured in cubic centimeters)

The problem gives us:

- $V = 48 \text{ cm}^3$
- $r = ?$ (the radius is given or known)

Our goal is to find h , the height of the cylinder.

The Volume Formula of a Right Circular Cylinder

The volume V of a right circular cylinder can be calculated with the formula:

$$[V = \pi r^2 h]$$

Where:

- π (π) is approximately 3.1416
- r is the radius
- h is the height

This formula tells us that the volume depends on both the square of the radius and the height. Rearranged, if the volume and radius are known, the height can be calculated as:

$$[h = \frac{V}{\pi r^2}]$$

Calculating the Height of the Cylinder

Given the volume $V = 48 \text{ cm}^3$ and the radius r , the height h can be found using:

$$[h = \frac{48}{\pi r^2}]$$

This formula emphasizes that the height is inversely proportional to the square of the radius.

Important: Since the radius r is not explicitly provided in the problem

statement, we need to consider different cases or possible values for r to find corresponding heights.

Case 1: Known Radius

Suppose the radius r is known or given. For example, assume r = 2 cm.

Calculate:

$$h = \frac{48}{\pi \times (2)^2} = \frac{48}{\pi \times 4} = \frac{48}{12.5664} \approx 3.82, \text{ cm}$$

Thus, if the radius is 2 cm, the height h is approximately 3.82 centimeters.

Case 2: Variable Radius

If the radius r is not specified, but you are asked to analyze how the height varies with different radii, then:

Radius (cm)	Calculation of Height (cm)	Explanation
1	$h = \frac{48}{\pi \times 1^2} = \frac{48}{3.1416} \approx 15.28$	Larger height with smaller radius
2	$h \approx 3.82$	As above
3	$h = \frac{48}{\pi \times 9} = \frac{48}{28.274} \approx 1.70$	Smaller height with larger radius

This table illustrates how increasing the radius decreases the height, maintaining the same volume.

Determining the Radius When the Height Is Known

Conversely, if the height h is specified, the radius can be found by rearranging the volume formula:

$$r = \sqrt{\frac{V}{\pi h}}$$

For example, if h = 4 cm, then:

$$r = \sqrt{\frac{48}{\pi \times 4}} = \sqrt{\frac{48}{12.5664}} \approx \sqrt{3.82} \approx 1.95, \text{ cm}$$

This reciprocal relationship shows how to determine the radius based on the height and volume.

Real-World Applications and Significance

Understanding how to compute the height of a cylinder with given volume and radius has numerous practical applications:

- Designing storage tanks where volume capacity is fixed and dimensions are optimized
- Manufacturing cylindrical components with specific volume requirements
- Calculating material needs for construction or packaging
- Estimating fluid capacities in engineering systems

In each case, knowing the relationship between volume, radius, and height ensures precise calculations and efficient designs.

Additional Considerations

While the straightforward formula provides the height directly, several factors may influence real-world measurements:

- Measurement errors: Variations in the actual radius or volume measurement can affect the calculated height.
- Material thickness: When designing physical cylinders, wall thickness may alter internal dimensions.
- Unit consistency: Ensure all measurements are in the same units (cm in this case) for accurate calculations.

Summary of Key Points

- The volume of a right circular cylinder is given by $V = \pi r^2 h$.
- To find the height when volume and radius are known: $h = V / (\pi r^2)$.
- For a volume of 48 cm^3 :
- If $r = 2 \text{ cm}$, then $h \approx 3.82 \text{ cm}$.
- If $r = 1 \text{ cm}$, then $h \approx 15.28 \text{ cm}$.
- If $h = 4 \text{ cm}$, then $r \approx 1.95 \text{ cm}$.
- The relationship between radius and height is inversely proportional when volume is constant.

Conclusion

Determining the height of a right circular cylinder given its volume and radius involves a fundamental understanding of the geometric formula $V = \pi r^2 h$. By rearranging this formula, we can calculate the height directly when the volume and radius are known. Conversely, if the height is specified, the radius can be derived. This relationship is essential in various practical fields such as engineering, manufacturing, and design, enabling precise calculations and informing effective decision-making.

Always ensure accurate measurements and unit consistency for reliable results. Whether designing a storage tank, manufacturing a component, or solving a mathematical problem, understanding the interplay between volume, radius, and height is crucial.

For further reading and practice:

- Explore problems involving cylinders with different volumes and dimensions.
- Study the surface area of cylinders for comprehensive understanding.
- Practice deriving formulas and manipulating algebraic expressions related to geometric shapes.

By mastering these concepts, you'll strengthen your spatial reasoning and mathematical skills applicable across numerous disciplines.

Frequently Asked Questions

What is the height of a right circular cylinder with

a volume of 48 cubic centimeters and a radius of 3 centimeters?

Using the volume formula $V = \pi r^2 h$, we solve for height: $h = V / (\pi r^2)$.
Substituting values: $h = 48 / (\pi 3^2) = 48 / (\pi 9) \approx 48 / 28.274 \approx 1.70$ centimeters.

How do you calculate the height of a cylinder when the volume and radius are known?

The height is calculated using the formula $h = V / (\pi r^2)$. Divide the volume by the area of the base (πr^2) to find the height.

If a right circular cylinder has a radius of 5 cm and a volume of 48 cm³, what is its height?

Calculate height as $h = 48 / (\pi 5^2) = 48 / (\pi 25) \approx 48 / 78.54 \approx 0.61$ centimeters.

What are the key formulas involved in finding the height of a right circular cylinder given its volume and radius?

The main formula is $V = \pi r^2 h$, which rearranged for height is $h = V / (\pi r^2)$.

Can the height of a cylinder with a volume of 48 cm³ and radius of 2 cm be determined directly? If so, what is it?

Yes. Using $h = V / (\pi r^2)$: $h = 48 / (\pi 2^2) = 48 / (\pi 4) \approx 48 / 12.566 \approx 3.82$ centimeters.

Additional Resources

What Is The Height Of A Right Circular Cylinder That Has A Volume Of 48 Cubic Centimeters And A Radius? This question invites a deep dive into the geometric principles of cylinders, the mathematical formulas involved, and the practical applications of understanding such calculations. Determining the height of a right circular cylinder when given its volume and radius is a common problem in geometry, engineering, and various scientific fields. It not only reinforces fundamental concepts but also showcases how algebra can be applied to real-world scenarios.

Understanding the Basics of a Right Circular Cylinder

A right circular cylinder is a three-dimensional geometric shape characterized by two parallel circular bases connected by a curved surface. The defining features include:

- Radius (r): The distance from the center of the circular base to its edge.
- Height (h): The perpendicular distance between the two bases.
- Volume (V): The amount of space occupied within the cylinder.

Mathematically, the volume of a right circular cylinder is given by the formula:

$$V = \pi r^2 h$$

This formula is fundamental because it links the volume, radius, and height, allowing us to solve for any one of these variables if the others are known.

Key Concepts and Formulas

Volume of a Right Circular Cylinder

The volume formula, as mentioned, is:

$$V = \pi r^2 h$$

Where:

- V is the volume,
- r is the radius,
- h is the height,
- π is approximately 3.14159.

Given the volume and the radius, the primary goal is to find the height:

$$h = \frac{V}{\pi r^2}$$

This simple rearrangement underscores the importance of understanding algebraic manipulation to solve geometry problems.

Given Data and Unknowns

- In our case:
- $V = 48$ cubic centimeters
 - $r = \text{unknown}$ (or given in a specific problem statement)

The problem can be approached in two ways:

1. If the radius is provided, directly substitute into the formula to find the height.
2. If only the volume and an expression involving the radius are given, then the problem may involve solving for the radius first or considering different scenarios.

Calculating the Height

Suppose the radius r is known. The steps to find the height are straightforward:

1. Write down the volume formula:

$$h = \frac{V}{\pi r^2}$$

2. Plug in the known volume:

$$h = \frac{48}{\pi r^2}$$

3. Simplify and compute the height based on the specific radius.

Example: If the radius is 3 cm:

$$h = \frac{48}{\pi \times 3^2} = \frac{48}{\pi \times 9} = \frac{48}{28.2743} \approx 1.697 \text{ cm}$$

This example shows that with a radius of 3 cm, the height is approximately 1.697 cm.

Exploring Different Radius Values

Since the initial question may lack a specified radius, let us explore how the height varies with different radii:

Radius (cm)	Calculation	Height (cm)	Notes
-------------	-------------	-------------	-------

-----	-----	-----	-----
1	$\backslash(h = 48 / (\pi \times 1^2) = 48 / 3.14159 \approx 15.28 \backslash)$	15.28	
Small radius, large height			
2	$\backslash(h = 48 / (\pi \times 4) = 48 / 12.566 \approx 3.82 \backslash)$	3.82	
Moderate radius			
4	$\backslash(h = 48 / (\pi \times 16) = 48 / 50.265 \approx 0.955 \backslash)$	0.955	
Larger radius, smaller height			

This table illustrates the inverse relationship between radius and height when volume is fixed: increasing the radius decreases the height and vice versa.

Applications and Importance

Understanding how to determine the height of a cylinder given volume and radius has practical implications:

- Manufacturing: Ensuring containers or cylinders meet specific volume requirements.
- Engineering: Designing components like pipes, tanks, or columns.
- Science: Calculating the dimensions of cylindrical samples or containers for experiments.
- Education: Reinforcing algebraic manipulation and geometric concepts.

Pros and Cons of the Calculation Approach

Pros:

- Simplicity: The formula $\backslash(V = \pi r^2 h \backslash)$ provides a direct method to find the height.
- Universality: Applicable across disciplines involving cylindrical shapes.
- Flexibility: Can be used to solve for any variable if the others are known.

Cons:

- Assumes perfect geometric shapes: Real-world objects may deviate from ideal cylinders.
- Requires accurate measurements: Small errors in radius lead to significant errors in height calculation.
- Limited if radius is unknown: Additional information or measurements are necessary.

Advanced Considerations

In more complex scenarios, additional factors might influence the calculation:

- Non-Uniform Materials: When the cylinder's density varies, volume alone may not suffice.
- Oblique Cylinders: When the cylinder is tilted, the height calculation requires different approaches.
- Real-world Irregularities: Manufacturing tolerances can affect the precision of the height estimation.

Furthermore, in cases where the radius is not explicitly given, but other parameters are known, inverse problems may need solving—often involving quadratic equations or iterative methods.

Summary and Final Thoughts

To conclude, the height of a right circular cylinder with a volume of 48 cubic centimeters depends directly on the radius. Using the fundamental volume formula:

$$h = \frac{V}{\pi r^2}$$

we can derive the height once the radius is known. The relationship between radius and height is inversely proportional when volume is constant, meaning that increasing the radius reduces the height, and vice versa.

This calculation is foundational in geometry and has numerous practical applications across industries and academia. It emphasizes the importance of understanding core formulas and algebraic manipulation, enabling professionals and students alike to solve real-world problems efficiently.

In summary:

- Precise measurement of the radius is crucial.
- The formula is straightforward but requires careful algebra.
- Variations in the radius significantly impact the height.
- Practical applications abound, making this a vital concept in science and engineering.

By mastering these principles, one can confidently tackle a wide range of problems involving cylindrical shapes, ensuring accuracy and efficiency in design, analysis, and problem-solving contexts.

What Is The Height Of A Right Circular Cylinder That Has A Volume Of 48 Cubic Centimeters And A Radius

What Is The Height Of A Right Circular Cylinder That Has A Volume Of 48 Cubic Centimeters And A Radius

Related Articles

- [. A Car Bought For \\$20,000. Its Value Depreciates By 10% Each Year For 3 Years. What Is The Car's Worth](#)
- [What Happens To The Resistance Of A Resistor Made In The Form Of A Rectangular Block When All Three Of](#)
- [When Expanding A Business Internationally, Which Of The Following Is Most Important To Provide On Your](#)

[Back to Home](#)